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(71)(72) Applicant and Inventor: RUSSELL, David, C. [US/US]; 2967 Aldgate Drive, Bloomfield Hill, MI 48013 (US).

(74) Agents: GROSSMAN, Jon, D. et al.; Dickstein, Shapiro & Morin, 2101 L Street, N.W., Washington, DC 20037 (US).

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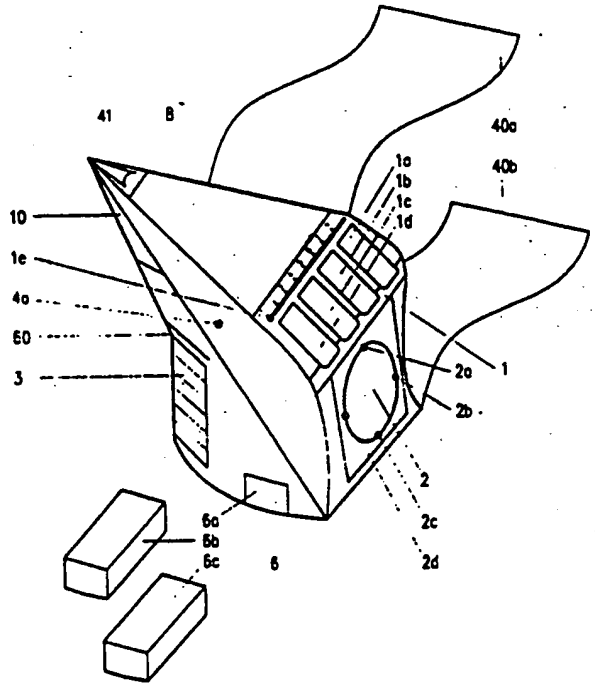

(57) Abstract

A bidirectionally operable, ergonomically-shaped, hand-attachable computer control system is disclosed. A hand-attachable user input device (10) transmits computer command, control, and other input signals to a base transceiver device (20), which detects and converts input device radiated signals into electrical signals to which the computer (30) is programmed to respond. A system is disclosed wherein multiple computers can be controlled, using multiple input devices (101-110), and control can be achieved by multiple users, to the extent of control privileges authorized by predetermined authorization plans.

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COMPUTER CONTROL SYSTEM

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to remote control systems. More particularly, the present invention relates to the remote entry of control signals into a computer system; also, the invention relates to the remote entry of other types of input and control data into a computer system or multiple computer systems.

DESCRIPTION OF THE PRIOR ART

In recent years, the process of entering certain types of data and control inputs into computer systems has become significantly simplified.

Traditionally, data entry to a computer, and other computer control and input operations, were accomplished using a standard computer keyboard data entry device. However, for many types of input and control situations, the standard keyboard proved to be inefficient, inconvenient, and time consuming.

Thus, in due course, it became apparent to inventors and computer users that input alternatives to the keyboard were desirable. Such auxiliary and/or alternative input devices such as light pens, joysticks, and the so-called mouse were invented. These new input devices proved

to be viable and timesaving alternatives to the keyboard for many types of input and control situations.

Accordingly, over the last several years, such auxiliary and/or alternative input devices have surged in popularity. In particular, the input device known as the mouse appears to have become the single most widely accepted keyboard alternative input device.

The fundamental operating control principle of the mouse relates to the rotation of a spherical "trackball". This trackball is partially exposed on the underside of the device; it protrudes through an aperture of "the mouse's" undermost panel. When the mouse is moved over a flat surface, the trackball can freely rotate within the device.

When the computer user moves the mouse, the exposed portion of the trackball is usually pressed against a flat surface urging the trackball to rotate and generate signals which correspond to pairs of x-axis and y-axis coordinates. The mouse contains means to translate these coordinates into signals to which the attached computer is responsive. Accordingly, when the computer user moves the mouse device across a working surface adjacent to the computer, the cursor indicator on the display screen moves to the location desired by the computer user. Also, the computer user's operation of one or more buttons aboard the mouse affects other control functions on the computer and display such as the selection of computer usage event options.

Notwithstanding contributions of alternative/ auxiliary input devices such as the mouse, a number of drawbacks inherent in the mouse have not been eliminated.

One drawback of the mouse is the fact that it is hard-wire attached to the computer whose cursor is being controlled. The connecting cord from the mouse to the computer is subject to the same "umbilical" problems associated with cords on any appliance which needs to move about in order to operate according to design.

Another drawback of the mouse is that a computer user may find the procedure of frequently moving his or her hand back and forth from the keyboard to the mouse to be distracting to their train of thought, time consuming, or inconvenient to optimal operational efficiency.

Still another drawback to be considered is the fact that the mouse requires a prominent space upon the computer user's desk. Also, the mouse requires a dedicated "running area" ideally comprising a smooth flat surface upon which to move. In practice, the typical computer user's desk is very often crowded, and the extra space required for mouse operation can often cause further crowding problems for the computer user. Further, not all computer user's desks offer a hospitable or a sufficiently smooth and flat "running area" surface; this can cause problems for proper operation of the mouse.

A further drawback of the mouse is the susceptibility of the underside of the trackball to introduce dirt and other foreign substances into the body cavity of the mouse.

Also, the mouse is not always capable of perfectly retracing its' path, should the computer user desire to

backtrack exactly. This deficiency can result in discontinuities in tracking and correspondingly discontinuous input events.

Some of the above-noted drawbacks have been partially addressed by some of the newer computer input device designs. For example, some mouse devices are designed to run on special running surfaces, eliminating those problems associated with surface imperfections. However, some of these mouse devices create additional pitfalls for computer users. In the event that the special running surface becomes damaged or becomes lost, imperfect mouse operation can result. Also, the provision of a special running surface consumes no less desktop surface than the conventional mouse requiring no special surface. Although some problems are reduced with the special running surface, no significant additional utility appears to result.

Thus, at this point, the hardwiring problems, the space consumption problems, and the distraction/efficiency problems caused by the mandatory back and forth hand movement of the mouse all remain to be substantially resolved.

Another drawback is that mouse-type devices can be inhospitable for those users who are physically impaired. For those users who have, for example, impaired tactile abilities, the mouse may be an awkward, if not painful, means for inputting information.

Several inventors' have attempted to address the above concerns.

For example, U.S. Patent 4,550,250 illustrates an infrared graphics input device for a computer. A remote infrared light source transmits user input commands to a detector device proximate to the computer. Although the device is wireless, this device appears limited because it must remain within the fixed confines of a small detection field. Also, this device must operate within a virtually dedicated two-dimensional, smooth flat surface. The detector apparatus operates according to continuous tracking input principles and apparently does not allow for any straying out of the detection boundaries for precision inputs; a straying out of these detection boundaries by the graphics input device would appear to inevitably damage precision needed by the detector's trigonometrically oriented position calculating method.

United States Patent 4,578,674 discloses a method and an apparatus for controlling the cursor position on a computer display screen. This device uses both infrared and ultrasonic principles for determining the direction and the velocity of motion of a positioning device which is monitored by a control base detector. Although the device is wireless, this device appears limited as disclosed and illustrated. If in fact this device is satisfactorily functional outside of a two-dimensional plane, while operating from a three-dimensionally defined location in free space, this device appears likely at best to require the computer user to take overly elaborate pains ensuring that the emitter/detector front face of the positioning device is always directly facing the control base.

United States Patent 4,628,541 discloses an infrared battery powered keyboard input device for a microcomputer. Specifically, the patent describes a keyboard device for keyboard data entry to a microcomputer this requires no connecting cord between the keyboard and the controlled microcomputer and it does offer the computer user additional freedom for operating a standard style keyboard input device without hardwiring constraints; however, this device still requires significant space for operation given that it is apparently no more conservative of space than any other standard keyboard. Also, as no separable signal detector unit appears to be available, the keyboard cannot be portable to another computer, unless the computer to which the keyboard is ported is a duplicate microcomputer device. Apparently, the infrared battery operated keyboard likely requires the implementation of a separate mouse if "mouse-type" input commands or functionality/features are either needed by the user or are required for optimal productivity.

These above patents all embody infrared and/or ultrasonic wireless data communications principles. While these inventions do serve as prior art improvements over the preceding basic "mouse-type" design, these inventions stop short of realizing and employing the full potential of data and/or sonic communications.

SUMMARY OF THE INVENTION

In view of the foregoing, it should be apparent that there still exists a need in the art for a method and apparatus for providing an effective means for the remote entry of control signals into a computer. The present invention herein disclosed offers numerous distinct features unavailable heretofore. The present invention simplifies and makes accessible the control of many events associated with the operation of a computer, eliminating the foregoing drawbacks associated with conventional input devices, such as the mouse. With the present invention, the computer user controls diverse computer control events, including data input events, cursor control events, selection of option events available to the user, using a wireless, hand-attachable input device.

It is therefore a primary object of the present invention to provide an input device that is easily attached to the index or other fingers and is virtually effortlessly operated by the computer user's thumb and/or finger pressure upon various switches aboard the wireless input device.

Another object is to provide a thumb and index finger computer control environment. The thumb operated switches comprise a master control thumb switch and a plurality of secondary switches and mode switches. The index finger switch operates the front computer control switch.

A further object of the present invention is to provide single-switch or multiple-switch operation accomplishable with minimum effort.

A further object of the invention is to provide a wide range of basic operating characteristics depending on the user's configuration of the device selected. Different operating features and different operating modes are available to the computer user, using this wireless input device. Moreover, different operating personality modules can be loaded into the wireless input device such that multiple removably insertable operating environments, each having a plurality of operating modes, are created; each of the modules contains a different basic format of operation for the input device. For example, the personality module can provide a number of security and access-safeguarding features based upon the needs of the computing environment, as defined by a duly authorized system security administrator.

An additional object of the invention is to receive signals radiated from the input device, in a base transceiver device which, is in turn, connected into the computer being controlled.

Yet another object of this invention is to provide an input device which is configurable to provide for an interoperable computing environment wherein a group or groups of computers can be controlled by one or more of the computer input devices.

Another object of the invention is that it is cordless and unbounded by either typical hardwiring

constraints or narrow boundaries which are counterproductive to the simplest operation. Due to the provision of a sensitive signal radiating means and sensing means, reliable transmission and reception of precise input signals can be accomplished without rigorous pointing or aiming of the input device.

A further object is that in a wider scale implementation, such as an enterprise-wide environment, interoperability can be achieved among multiple input devices and computers. For example, virtual simultaneous control of multiple computers is achieved by directing different control signals radiating out of the same input device.

A yet additional object of the present inventions is to provide an input device that operates from any three-dimensional location which is sufficiently proximate to the base transceiver. In other words, the input device does not require a smooth, flat, dedicated surface and/or a special input device as a "running area", as do devices of the prior art. As a result, more convenient operation occurs and premium desk space (which would be otherwise unavailable with devices of the prior art), is now rendered available for other users.

A further object of the invention is to give the computer user finger-tip control since the present invention can be attachable to the index finger and simply operated by the thumb and/or index finger. Such control allows the user to better keep his train of thought insofar as no back and forth hand movements are necessary from keyboard to input device. This capability can increase

productivity significantly in advanced applications, where extensive use of keyboard and input devices are required, such as in computer assisted design or manufacturing applications. Coupled with existing software using mouse interfaces, the present invention streamlines input and control. For example, a team of designers can virtually simultaneously work with a single computer to develop design diagrams around a conference table, using their respective hand-attachable input devices. Additionally, the present invention, when implemented in a computer gaming environment, allows multiple players to simultaneously compete in the same event.

A further object of this invention is to provide a control unit for an enterprise-wide computer security plant, using the interoperability characteristics of the present invention, wherein access can be differently constrained from individual user to individual user (and from device to device) depending on each user's (and device's) specific access and authorization privileges.

An additional object of this invention is to provide a device that addresses the special needs of the handicapped. For example, people, who for one reason or another, find usage of mouse-type input devices impossible or very inconvenient, can more easily communicate with their computer using the present invention.

It is another object of this invention to provide an input device that streamlines computer input, allows for any extent of security that is deemed appropriate for the implementation environment, and allows extreme portability of computing for any user.

Briefly described, these and other objects of the invention are accomplished with its apparatus aspects by providing a wireless computer input device adapted to communicate with a base transceiver. The input device is adapted, in one embodiment, to be mounted on the user's index finger in order to be easily operable by the thumb and index finger. The unit includes a personality module which can be set to any one of multiple personality environments by the user. The unit also includes multiple mode setting means within each personality module. Function control switches easily operable by the thumb and index finger are further provided which are settable in each mode.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of the wireless hand attachable computer user input device 10, and companion base transceiver device 20.

Figure 2 is a block diagram overview of the hardware implementation of the computer control system;

Figure 3 is a block diagram of basic functional modules of input device 10;

Figure 4 is a detailed schematic block diagram of the user input transmitter shown in Fig. 3;

Figure 5 is a block diagram of the base transceiver device 20;

Figure 6 is a detailed block diagram of the base transceiver device of Fig. 5;

Figure 7 is a top perspective view of the input device 10;

Figure 8 is a bottom perspective of the device 10;

Figure 9 is a bottom perspective view of a second embodiment of the device 10;

Figures 10A-10B are perspective views of the input device 10 in use;

Figure 11 is a perspective view of a second embodiment of the input device in use;

Figure 12 shows certain screen views of the operational sequences of the device 10;

Figure 13 illustrates a flowchart illustrating the security logic implementation environment for the device 10;

Figure 14 shows a block diagram of an enterprise-wide computer input system;

Figure 15 shows a block diagram of an extended enterprise-wide system; and

Figures 16A and 16B are block diagrams illustrating byte maps of different message packets of signals 12 of Fig. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figure 1 wherein like reference numerals refer to like parts, there is shown a wireless computer user input device 10, which transmits and receives infrared and/or other electromagnetic signals 12 such as RF, microwave or acoustic transmissions. If acoustic signals are used, the computer user input device 10 and base transceiver device 20 have appropriate acoustic transmission and reception circuitry. Such circuitry can be replaced by using well-known devices in order for the present invention to operate in the other previously mentioned signal transmission embodiments. In the instant embodiment, a detailed description of the signal transmission and reception circuitry is provided.

The signals 12 are transmitted from the computer user input device 10 in response to the computer user's manual operation of switches mounted thereupon (not shown). Specifically, after the user has actuated one or more switches on the input device 10, infrared and/or other transmitted signal-types 12 are generated within input device 10, and these signals are then passed through infrared lens 8 (see Fig. 7). The output signals 12 then propagate through free space and onto the base transceiver 20. Upon detection by the base transceiver 20, the signals 12 are demodulated, deencrypted, if applicable, and converted to applicable computer control signals and/or other input event signals. A detailed description of the transceiver 20 operation is provided further below.

These computer control signals are relayed into computer 30 via cable 28. Computer 30 is connected to terminal 18, and/or any other interfaceable receiver device. In the embodiment of Figure 1, display screen 19 of terminal 18 is responsive to command, control, and other output/display signals from the computer 30, such that the desired effects of user-initiated signals 12 are displayed on screen 19, and/or elsewhere, at the user's option.

In addition, the base transceiver 20 includes a sonic receiver element 42 adapted to receive and transmit the sonically produced signals from the input device 10.

The base transceiver 20 further includes a lens 21 adapted to pass infrared signals 12 provided from the input device 10. Other features of the base transceiver 20 include a keyboard panel 26. The keyboard panel 26 (where implemented) allows the user to type in an authorization code lock such that physical access to the base transceiver 20 can be programmably controlled by the user possessing the correct authorization codes. The purpose of the lock is to enable or disable access to ports 22 and 24.

Ports 22, 24 are provided on the base transceiver 20 for recharging the power supply in the input device 10. Specifically, port 22 (when implemented) is provided for a guest device which is where multiple input devices are provided to control one or more computers. Port 24 is used for recharging the home input device 10. The input device 10, as shown in Fig. 8, includes a female plug 11a coupled to receive electrical charges for an internal power supply (i.e., battery) in unit 10. The female coupling 11a is adapted to plug into a male coupling 116 respectively

located within each of the ports 22, 24 in the base transceiver 20.

The computer, screen 19 inherently includes pre-programmed cartesian or other conventional positioning areas representing coordinate positions provided by the input device 10. The ordinate axis 17b and the abscissa axis 17c are shown by the dotted lines. In addition, an origin 17a is provided through which a Z-axis (not shown) is available for three-dimensional display.

Additionally, the computer 18 has a floppy or other storage disc drive 32 which is adapted to receive a floppy or other suitable disc package 35 containing digitally encoded instructions 33.

Referring now to Figure 2, a block diagram overview of the basic computer control system is shown. The basic control elements include the wireless input device 10 (shown in Fig. 1), the base transceiver device 20 (also shown in Fig. 1) and the computer 30 controlled by the wireless input device 10 and the base transceiver 20.

Figure 3 illustrates the preferred hardware arrangement and detailed operations for performing basic signal-generating, signal processing, and signal-terminating functions for the input device 10.

Specifically, the manual, digital, or thumb operation of input device 10's switches results in the generation of different electrical signals which are propagated out of the switch position sensing module shown as module 100.

The electrical signals produced by module 100 indicate three separate but interrelated fields: (1) the actual switch position of the secondary control switches 1a-1d shown in Fig. 7, (2) the switch mode setting position 102 which controls functionality of switches 1a-1d as determined by the presetting of switch 1e of (Fig. 7) and (3) the operating environment (i.e., personality) of the system as defined by the personality module 6, which is plugged into or set in the device 10 (Fig. 7).

The signal produced by the position sensing module 100 is encoded so that the signal is then treated by an encoding/decoding module 110. A series of intermediate electrical signals provided from the encoder/decoder 110 are then transmitted to an infrared modulator transceiver 112 for appropriate transmission and reception based upon the transmission/reception settings of the switch 114. The transceiver can also operate to transmit/receive other types of signals including electromagnetic, acoustic or other electromagnetic signal types using conventionally known transceiver hardware.

As previously discussed, both the loaded personality and all mode settings for switches 6 and 1e (Fig. 7) are preprogrammed in the input device 10. Subsequent encoding of such modes and personalities are based upon pre-stored ROM modules containing data adapted to translate information provided from the position switches 100 or to, in turn, translate incoming signals from the transceiver 112.

The modulation plan memory 116 stores, in protected form, information for operation of the user input device 10. The encryption security information module 118 comprises data provided from the personality module ROM 6 to enable operation that environment. Module 118 can be implemented in a ROM which is physically connected to the device 10 by means of a plug-in module 6.

The personality data, in the security environment, for example, includes security or other access safeguards. These safeguards may include control information for the keypad 26 (Fig. 1) which enables external entry of access codes, other keywords or authorization inputs. Another example of the pre-stored personality operating environments 118 for device 10 include a CAD/CAM control environment.

The security safeguard data 118 constrains any user's access to a computer implementing the present invention to the extent of that user's privileges. A related concept is that any user's access to multiple computers can be constrained in an environment where each computer implements the present invention. Likewise, multiple users can access multiple computers, to the extent of their respective access privileges, within a computing group or groups (such as one or more local area networks) or within a wider network of interconnectable computing groups, such as an enterprise-wide computing environment, or such as multiple interconnectable and/or concatenable enterprise-wide computing environments.

Referring now to Figure 4 a detailed block hardware diagram of input device 4 is shown. The elements of the

block diagram include a micro-controller 400 which acts to encode and decode various signals provided to it, including command data and programs which can be read into the micro-controller's RAM (not shown) from the ROMs 116, 118. In addition, the micro-controller receives various input signals from the secondary control switches 1a-1d, the mode control switch 1e, the master control thumb switch 2, and the front toggle switch 3 (not shown). The encoded data from the micro-controller 400 is then provided to or received from the transceiver device 112. The other elements of the input device, which shall be described in greater detail further herein include data input ports 4A and 4B which are adapted to receive data from other devices connected to the input device 10.

Power for the input device 10 is provided through a battery 402 which is adaptable to be recharged via charge and control circuit 404 connected to the female charge plug 11a. As previously discussed, the plug 11a is adapted to be plugged into a male charging plug 11b located on the base transceiver unit 20.

Fig. 5 is a block diagram of the hardware arrangement of the base transceiver 20. The input signals 12 to transceiver 20 are outputs from the computer user input device 10 of Figure 1. More specifically, inputs to base transceiver 20 can comprise, in one embodiment, infrared radiant energy and/or other electromagnetic radiation, optical or acoustic signals 12, comprising user-initiated signals from the transceiver of input device 10.

The signals 12 are received by an infrared transceiver device 210. Alternatively, or in addition, a

sonic or optical transceiver device (not shown) can be implemented in order to facilitate communication with other signal types. The transceiver is connected to an encoder/decoder circuit 212 to decode/encode signals 12, as described above. Demodulation occurs in a reverse manner to modulation, as is common practice. Information for the encoding/decoding device 212 is provided through a memory element 214. The memory element 214 comprises one of several ROM circuit alternatives, one of which (illustrated) includes a predetermined security table 216 while the other includes a programmable security coding module 218 (optional). Furthermore, a ROM or other suitable storage device 220 is employed to provide for modulation/demodulation of data in accordance with the preset modulation scheme contained in the input device 10. As a result, after incoming signals 12 are received by transceiver 210, they are supplied to the encoding/decoding module 212 for subsequent decoding based upon information provided from memory 218 and memory 220. The decoded signals are then outputted from the encoder/decoder 212 to a mode switch position sensing device 225.

The modulation plan contained in memory 220 interfaces with security module memory 218 for security processing of the signal if a security personality has been loaded and enabled in device 10. The demodulated and decrypted signals are outputted from the decoder 212 as inputs to mode and switch position sensing device 225. The device 225 consists of any conventionally known circuit arrangement adapted to both detect all original switches states in input device 10 and to transfer those states to a computer 30. An example of device 225 is a serial-to-parallel shift register or any other suitable buffer.

Demodulated and decrypted intermediate signals transferred into device 225 are initially examined by the mode detection submodule 232 in order to determine which mode (set by switch 1e in Fig. 7) the subsequent signal is based upon. As previously noted, the mode switch settings 1e comprise a multiplicity of different possible signal intelligence generation options stored in the ROM mode table 116. Depending on the mode in which the computer user input device 10 is operating, different data is conveyed in the subsequent portions of the signal being processed.

Also, depending on the personality operating environment implemented through the modules (6a, 6b and 6c of Fig. 7) a plurality of different operating environments are possible, in addition to a plurality of mode settings 1e within each personality environment.

The difference between an operating environment personality 6 and a mode switch setting of switch 1e, as shown in Fig. 7 is as follows: If a user wishes to set a particular operating environment (i.e., security access), he/she does so, in one method, by plugging a ROM module 6 into the input device 10. Contained within an operational environment, such as security access, CAD/CAM, etc. are a plurality of modes 1e each of which, in turn, control the functions designated by switches 1a-1d. For example, in a CAD/CAM operating environment, one selected mode may be "input formatting" when a user wishes to designate various input formats on his computer. As a result, the secondary control switches 1a-1d designate particular functions available in mode setting 1 (i.e., coloring, shading, hatching, providing standardized geometric figures, etc.).

A second mode designated by the switch 1e, for example, would involve an "output formatting" mode with the color, style, and formatting selections being designated by the secondary control switches 1a-1d. Accordingly, multiple operating modes and corresponding switch functions 1a-1d are available for each personality.

After mode detection submodule 225 has determined the mode 1e, the subsequent portions of the signal are relayed to an array of other switch position sensing submodules 234, 236, 238, and 240 corresponding to each implemented switch (1a, 1b, 1c, and 1d) of unit 10. In other embodiments (not shown) additional switch position sensing submodules can be provided to detect various states of the control inputs from device 10's switches. Thus switch 2 and the front switch 3 (Fig. 7) or any other embodiment bearing any other numbers of switch elements may be implemented. Accordingly, each switch on input device 10 implements a part of the signal train 12. Conversely, each switch position sensing submodule 234-240 of module 225 determines signal segments corresponding with each predetermined and presequenced segment of any signal related thereto. According to the present invention, at least as many switch position sensing submodules are implemented in module 225 as necessary to sense all switch signal segments from any computer user input device.

In practice, the computer 30 to be controlled can be accessed by a user input device 10 bearing, any number of position sensing submodules. Correspondingly, register 225 can bear as many switch position sensing submodules (such as 234-240) as computer input devices 10's largest

switch complement within any given enterprise or computing institution.

Fig. 6 illustrates a detailed block diagram showing the construction of the base transceiver 20. As shown, an infrared transceiver 210 is connected to a micro-controller 600. The micro-controller receives information from memories 214 and 220 which respectively store predetermined modulation plan data and security coding or other personality data as desired. Further, a ROM 218 is provided in order to provide the switch position sensing data necessary for encoding or decoding signals 12. The computer is also connected to the computer interface 30.

After signals 12 have been detected by the base transceiver 20 and each implemented submodule within the register 225 has detected their respective signals which indicate the switch position settings, all detection and determination outputs are summed by device 244 in a manner conducive to their conveyance and are converted to an input signal format which is appropriate for controlling events associated with the computer 230. This summed signal 242 is then "packetized" with appropriate start-message and end-message packet delimiters to simplify signal detection. Details of various packetized signals are provided in Figs. 16A and 16B.

As previously noted, the cable 28 connects the summation signal of all determined intelligence from the output of base transceiver 20 to the input of an appropriate input port (not shown) located on the reverse face of computer 30. Upon receipt of the summation signal outputs from base transceiver 20, the computer 30 (via

driver software 33) then interprets the summation signal 42. In response, the computer 30, invokes control over the output of display screen 19 of terminal 18 or otherwise invokes control over any other compatible and connected display device (not shown). The computer can also invoke control over any implemented controllable peripheral device via a direct and dedicated connection and/or via an indirect dedicated or virtual network connection.

Fig. 7 illustrates a detailed perspective view of the input device 10. As previously noted, the input device 10 includes a master control thumb switch 2 which is a primary operating switch for the user's computer controlling commands. This switch can be easily thumb-operated in order to control motion of the computer cursor in all directions 2a, 2b, 2c and 2d in accordance with the cartesian coordinates 17(a), 17(b), 17(c) of Fig. 1 (or other coordinates, e.g. polar coordinates). Three dimensional coordinates along a Z axis (not shown) are also available through the switch 2 when the input device 10 is provided with an appropriate three-dimensional personality choice 6 or mode selection 1e.

In different embodiments (not shown) other switches can be mounted upon the control surface 1. The other switches can vary in number, depending upon the model of computer being interfaced or computer environment being served. Input device 10 in the preferred embodiment, contains four adjacent secondary control switch elements, 1a, 1b, 1c, and 1d. Each of the secondary switches respectively provides a different functional choice to the computer. In other words, switches 1a, 1b, 1c and 1d are analogous to the function keys on a computer keyboard.

On the front face of input device 10 a "click switch" 3 is provided which operates in an analogous fashion to selection switches typically available on "mouse-type" input devices. In the preferred embodiment, the front switch 3 can toggle upward or downward and click "on" so that data upon which the cursor rests is entered into the computer 30. The capacity to perform these and other control actions allows the user to access a variety of control options in the computer 30. In yet other embodiments, the front switch 3 can, from its center position, "click" directly inward one or more times to perform yet other "click" or multiple "click" functions.

The input device 10 does not require strapping to the user's hand, finger, wrist, etc., in order to operate properly. While strapping by means of a "Velcro®" strap 40A and "Velcro®" strap 40B, is useful, the strapping does not affect the basic function of the input device 10. Moreover, other strap designs or arrangements are contemplated. For example, other fastening devices can be used for attachment of the computer user input device 10 to the human hand, wrist, finger, etc., such as a ring or ring-type fastening device, as illustrated in Figures 10A-10B or 11.

Returning to Fig. 7, the mode switch 1e is situated above control surface 1. Mode switch 1e is a sliding switch, which slides from position 1e.1 to position 1e.8, as implemented in the user input device 10. It is emphasized that other implementations for mode switch 1e are contemplated. As previously discussed, the mode switch 1e has significant operational implications in that it sets

the functional mode for the various functions represented by switches 1a-1d. Thus, each position switch 1a-1d can, in turn, be changed eight times depending upon the setting of mode switch 1e. The mode data functions are stored in a memory table, the access of which depends upon the setting of the switch 1e. The changing of the mode switch setting 1e thus significantly changes the operating characteristics of switches 1a-1d and, in turn, the user input device 10.

Still referring to Figure 7, a lens 8 or any other appropriately implemented signal transmissive means for predetermined selected infrared or other signal type 12 is provided. At the end of lens 8, an acoustic signal emission port 41 is illustrated. The computer user input device 10 implements an acoustic emission and detection option. The acoustic port 41, in conjunction with acoustic signal generation means, can emit predetermined selected acoustic signals, when enabled. Where implemented, port 41 requires a corresponding implementation of port 42 on base transceiver 20 of Fig. 1. Port 42 is an acoustic detector, and acoustic signals (not shown) emitted from port 41 are detected therewith. Any known conventional acoustic transceiver hardware can be used.

Referring still to Figure 7, the personality module 6a is shown loaded into the input device 10. The personality module 6a can be easily removed from the personality module cabinet 6. The module consists of, for example, a ROM having stored within it the various predetermined functions and data associated with the operating environment choice. Depending upon the personality module selected by the user, different primary

operating "personalities" of the computer user input device 10 can be chosen by the computer user.

In Figure 7, alternative personality modules 6b and 6c can be selected by the computer user to implement different fundamental operating environments. Other personality modules (not shown) can also be used to replace installed personality module 6a simply by removing module 6a from cabinet 6, and inserting either module 6b or module 6c (or any other module). In another embodiment (not shown) a miniature personality module comprising a thin flat storage device can be loaded. One or more such miniature personality modules can be stored in a shelf 60 located on the input device.

A data input port 4a can also be used for a variety of data inputs. For example, the port can be used to input data directly into one of the ROM areas. The input port 4a allows the computer user input device 10 to import or export security data such as access authorization codes, or allows the import or export of other data.

Referring now to both Figures 8 and 9, these figures differ only in the means for attaching the input device 10 to the user's hand. The means for attaching input device 10 to the computer user's finger can be implemented by a pair of "Velcro®" straps, such as strap 40a and strap 40b in Figure 8. In contrast, in Figure 9, the means for attaching the computer user input device 10 to the computer user's finger can be a releasably secured ring 50. Figures 10A and 10B shows the input device 10 worn on the user's index finger.

Referring to Fig. 11, a second arrangement 1100 of the input device is shown on a user's finger. The device is a simplified version of device 10 and includes only a thumb switch 1102 which operates in a similar fashion to switch 2.

Referring now to Figure 12, a series of different, sequential examples of cursor movement events are shown. In screen 1204a, the default position, 1217a, is shown in the center of the screen. Screen 1204a is always the beginning screen of a cursor reinitialization sequence. Default position 1217a is always presented to the computer user with any basic cursor reinitialization control sequence, unless an alternative default position is customized by the user. Reinitialization of the cursor is accomplished by, for example, using the function switches 1a-1d. Secondary successive screens show a progression of directional cursor moves as well as some "click" and "click and drag" sequences from the menu options, using switches 2 and 3. For example, directional pressure on switch 2 moves the cursor up in the direction of direction 2a; cursor right, 2b; cursor down, 2c; and cursor left, 2d (see Fig. 7). Other directions are possible and can be implemented with appropriate switching circuitry.

Referring now to Figure 13, a flow chart example of a possible sequence of events 1300 of one personality environment 6 is shown. In this example, the computer user who desires access to any computer 300 equipped with the present invention is designated as an "annunciator", and the logic used by the security module contained in the base transceiver 20 and input device 10 is designated as an "interrogator".

The process begins by having the interrogator start operation of the authorization program at step 1302. The sentry monitor transaction monitor routine then occurs at step 1304. At step 1306 the interrogator then tests to see if a annunciation/initiation signal has been received from the annunciator. The annunciator can only send a signal after it enters the annunciator routine by selecting the appropriate mode switch 1e and function switches 1a-1d.

The annunciator routine starts at step 1308 where the user must provide annunciation signal 1310. The annunciator then transmits the annunciation signal at step 1312. When the annunciation signal is received, the process for identifying the annunciator begins at step 1314. At step 1316 the interrogator then generates a "Who Are You" inquiry to the annunciator device. Once the annunciator signal is received at step 1320, the annunciator then begins to process the "Who Are You" identification request. If the "Who Are You" signal is not received, then the annunciation signal is regenerated at steps 1310, 1312.

The annunciator "Who Are You" identification process begins at step 1324 where identification information is fetched from the memory 1322 contained in the annunciator. Once an identification code has been read from a memory 1322, it is transmitted at step 1324 to the interrogator. The interrogator then tests to see if the ID has been received at 1328. If not, then at step 1328, the interrogator loops back N number of time to reinitiate the identification process. Once the N number of loops have

been exceeded, however, then an alarm routine is called at step 1330.

If, on the other hand, the ID has been received, then the authentication process initiates at step 1332 where ID data is read from an authenticator memory 1336 by virtue of the authentication read module 1334. An ID status message is then produced at step 1338 and the ID is then compared to see if it is contained within the authenticator memory at step 1340. If not, then the authenticator ID again tested at step 1342 and if the test indicates that the ID is not authorized, then the alarm routine is called at step 1344.

If, however, the ID is considered to be correct then at step 1346 the computer enabling process is entered. Two events then occur: First, the annunciator process is enabled at step 1348; second, the interrogator computer is enabled at step 1330.

The annunciator enable 1348 then transmits the enabled signal at step 1352. On the annunciator side, the enable process is initiated at step 1354. Before any enablement occurs, however, the system tests at step 1356 whether more work is being done. If the answer is yes, then the system will loop back till that work is completed and, once enabled, it will end the routine.

In the interrogator, if the computer enable routine 1350 occurs, the system tests to see if the transaction to be enabled is legal. If it is, then the system is tested to see if there is more work being performed at step 1364 and the system then loops back at step 1366 to the

transaction sentry monitor. However, if no more work is being performed then at step 1368, the routine is completed and the function is returned to the main menu.

In the event an alarm is sounded at steps 1370, 1344 and 1330, as previously described, an alarm test routine 1380 is entered. This routine, which occurs at the annunciator side, verifies the disable signal by entering the process at step 1388. At step 1384 the process recheck occurs where identification is rechecked against the annunciator memory at step 1386. If the recheck is successful at step 1390, then the annunciator signal is sent to the interrogator where the identification process 1326 begins again. If after two tries, however, no identification is found or the identification is wrong, then at step 1392 it is determined whether the device needs to be reenabled. If yes, the process enable routine 1340 occurs. However, if not, the alarm routine checks the memory 1322 and provides the annunciator with the appropriate indications of a default and disable.

An added feature of the input authorization personality 1300 is provided in box 1400. In this box, when the alarm routines 1394 are tested, a copy of all dialogues is sent at step 1402 to the interrogator or a sentry monitor 1404 and the memory 1336 is checked to see if other alarm conditions or messages or other intervention actions are possible. Thus, in this example, alarm conditions are handled by the interrogator.

The present invention has a virtually unlimited capacity to enable extensive multiple-level security programs. Security can be physically implemented using

keypad 26 of transceiver 20, and/or electronically implemented by installing the input device 10 with electronic access codes and access can additionally be constrained by virtue of loading a specific security access personality module 6 into cabinet 60.

Referring now to Figure 14, groups of computers are shown arrayed within a computing institution or enterprise. The properly authorized user of the present invention can gain access to any computer which has implemented the present invention, under the overall organizational auspices of an all-encompassing security safeguarding program.

Throughout this document, the term "transceiver" has been used to illustrate that according to the present invention, both a "transmitter" and a "receiver" are provided together in close proximity for two-way, or "duplex" operation (i.e., base transceiver 20 has both a transmitter and a receiver contained within the same electronic enclosure, as both transmission and reception of signals are provided therein). By like reasoning, the user input device 10 can also be designated as a "transceiver" given its duplex communications capability shown by "kill circuit" and other "receiver" functions.

Referring now to Figure 15, an extended enterprise-wide computer control system is illustrated. Figure 15 shows six sets of twenty computers. Each of these "local" six sets of computers is directly associated with ten local computer user input devices. In this particular case, all twenty computers local to each set can be controlled by all ten local computer user input devices associated with each

individual set. Figure 15 thus illustrates an implementation of the present invention which has subdivided an enterprise-wide group of one-hundred twenty computers into six operating groups which operate in a mutually exclusive fashion. Separately, shown to the left of the 120 computers are four grandmaster input devices 10, labelled I, II, III, and IV. Each of these grand master input devices can access all one-hundred twenty of the enterprise's computers.

Figure 15 therefor exemplifies an enterprise which has several separate operating groups of computers; in this example, there is no need for operators in any group to have access to any other group, since only the four grandmaster global input devices have access to all one-hundred twenty computers. Each group of ten computer input devices could be implemented to access other groups of computers; but in this implementation, only grandmasters access all six groups.

Figures 16A and 16B each respectively illustrate examples of packet byte maps for different personality modes for the system.

Although only a preferred embodiment is specifically illustrated and described herein, it will be apparent that many modifications and variations of the present invention are possible in light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

WHAT IS CLAIMED IS:

1. A computer control system, comprising an input device operable by a user, means operable by said input device to radiate signals, means to sense said radiated signals, and a computer having means to receive such signals and programmed to respond to them, the computer input signal being transmissible from the signal radiating means to the computer without use of any hardwire connection therebetween.

2. The computer control system of Claim 1, wherein said input device comprises a first transceiver.

3. The system of Claim 1, wherein said means operable by said input device comprises at least one manually operable element means for making at least one electrical connection to said means to radiate signals.

4. The system of Claim 3, wherein each said at least one manually operable element means can be operated in more than one basic operating mode.

5. The system of Claim 4, wherein each of said more than one basic operating modes comprises a different selectable intermediate electrical connection means for making a correspondingly different selected intermediate electrical connection from said manually operable element means to said means to radiate signals, prior to making a final electrical connection to said means to radiate signals.

6. The system of Claim 5, wherein each of said basic operating modes is selected using a manually operable basic mode selector element means.

7. The system of Claim 1, wherein said means to sense said radiated signals comprises a second transceiver.

8. The system of Claim 7, wherein said second transceiver comprises additional means to radiate signals, either independent of, or in response to, said first transceiver initiated radiated signals.

9. The system of Claim 8, wherein said second transceiver initiated radiated signals can be sensed by additional sensing means included within said first transceiver.

10. The system of Claim 9, wherein said second transceiver initiated radiated signals sensed by said first transceiver sensing means can effect feedback and control events in said first transceiver, including control events which can disable operation of said first transceiver.

11. The system of Claim 1, comprising said first transceiver and said second transceiver which are together bidirectionally operable as a two way transceiver system.

12. The system of Claim 11, wherein said two way transceiver system comprises means to simultaneously bidirectionally operate or to non-simultaneously bidirectionally operate, said bidirectional operability being initiable either by said first transceiver or by said second transceiver.

13. The system of Claim 12, wherein said bidirectionally operable two way transceiver system comprises said means to radiate signals, said means to sense said radiated signals, means to modulate said radiated signals, means to modulate said radiated signals to produce selected predetermined different modulated signals, means to determine which of said selected predetermined different modulated signals has been sensed by said sensing means, means for conversion of said sensed signals into different information signals to which said computer is programmed to respond, means for relaying said different information signals into a signal input port on said computer, and means for processing said different information signals within said computer to produce correspondingly different electrical signals to invoke different events of computer control including different computer screen display events upon a computer display screen responsive to said different electrical signals from said computer, and means to display said different events of computer control upon a computer display screen responsive to said produced electrical signals, when said two way transceiver system operates at the initiation of said first transceiver.

14. The system of Claim 1, wherein said input device has means which allow it to radiate signals to at least one signal sensing means, said at least one signal sensing means comprising means for accessing and controlling at least one computer, in accordance with a predetermined input device access and authorization privileges plan.

15. The system of Claim 14, wherein said predeterminedly configured input device, to the extent of its control privileges allowable by said predetermined input device access and authorization privileges plan, is operable by at least one user to control said at least one computer, to the extent of said at least one user's individually assigned access and authorization privileges as predetermined in a user access and authorization privileges plan.

16. The computer control system of Claim 14, wherein said predeterminedly configured input device is a member of at least one group of similar input devices, said at least one group also comprising predeterminedly configured input device group members, each of which said input device group members are individually and predeterminedly assigned access and authorization privileges exclusive of any access and authorization privileges assigned to any user.

17. The computer control system of Claim 1, comprising additional computers, additional users capable of controlling said additional computers, and additional input devices as means to control said additional computers.

18. A computer control apparatus, comprising an input device operable by a user, means operable by said user to radiate signals, means to receive said radiated signals, and a computer having means to receive such signals and programmed to respond to them, the computer input signal being transmissible from the signal radiating

means to the computer without use of any hardwire connection therebetween.

19. The computer control apparatus of Claim 18, wherein said means to radiate signals comprises a hand attachable computer user input device which is manually operable using any metacarpal of the hand in accordance with any specific embodiment employed as an encasing means to enclose said means to radiate signals therewithin.

20. The system of Claim 11, wherein said two way transceiver system can be dependently or independently integrated with and interconnected into other networked or networkable communications systems as means for extending the utility of said other systems, wherein means for said integration with an interconnection into said other systems comprises one or more physical, electrical, logical, and/or other networkable integration and/or interconnection means.

21. The system of Claim 11, wherein said two way transceiver system comprises means for creating specialized displays upon a computer display screen when configured with appropriate hardware and software means to produce said specialized displays.

22. The system of Claim 21, wherein said appropriate hardware and software means to produce said specialized displays can be explicitly customized and installed into either said first transceiver, or said second transceiver, or both said first transceiver and second transceiver in accordance with an installation configuration most appropriate for the user environment implementation.

23. The system of Claim 3, where in said means operable by said input device includes at least one master control thumb switch, most easily controllable by the user's thumb, said thumb switch comprising means to make different and/or multiple electrical connections to said means to radiate signals, and wherein said means operable by said input device may also include at least one manually operable element which can be most easily controllable by the user's index finger.

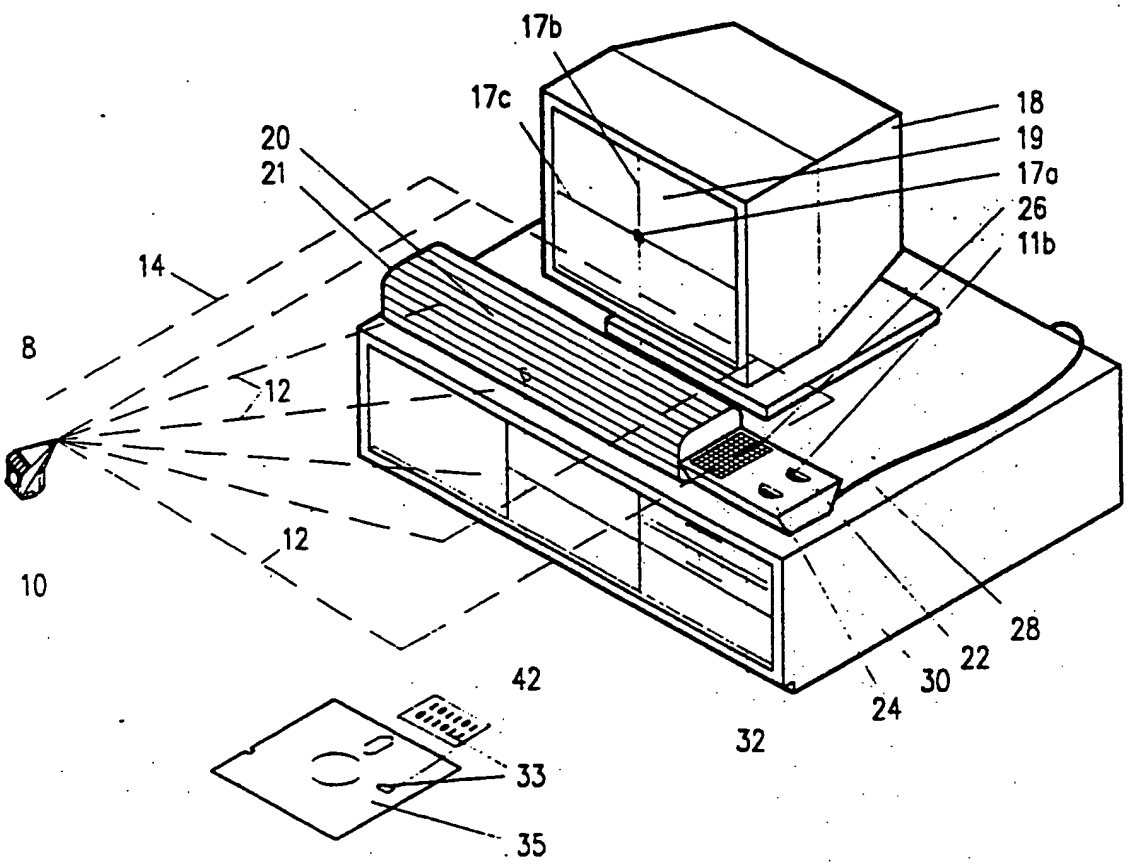


FIGURE 1

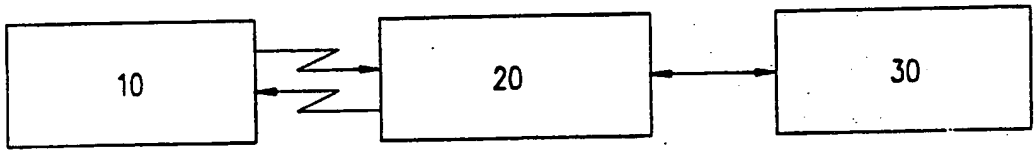


FIGURE 2

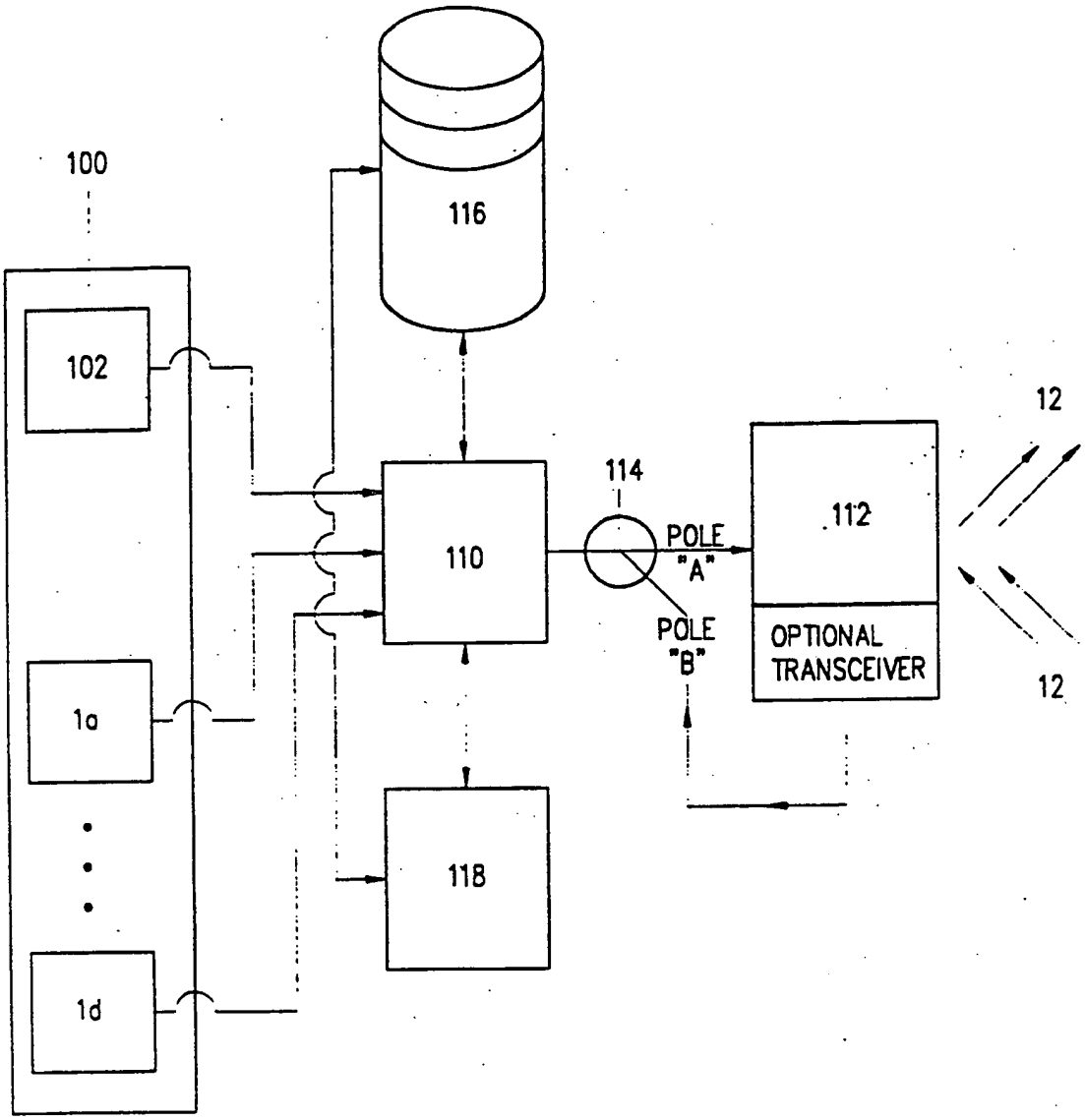

100
116
102
12
114
110
POLE "A"
112
POLE "B"
OPTIONAL TRANSCEIVER
12
1a
118
1d

FIGURE 3

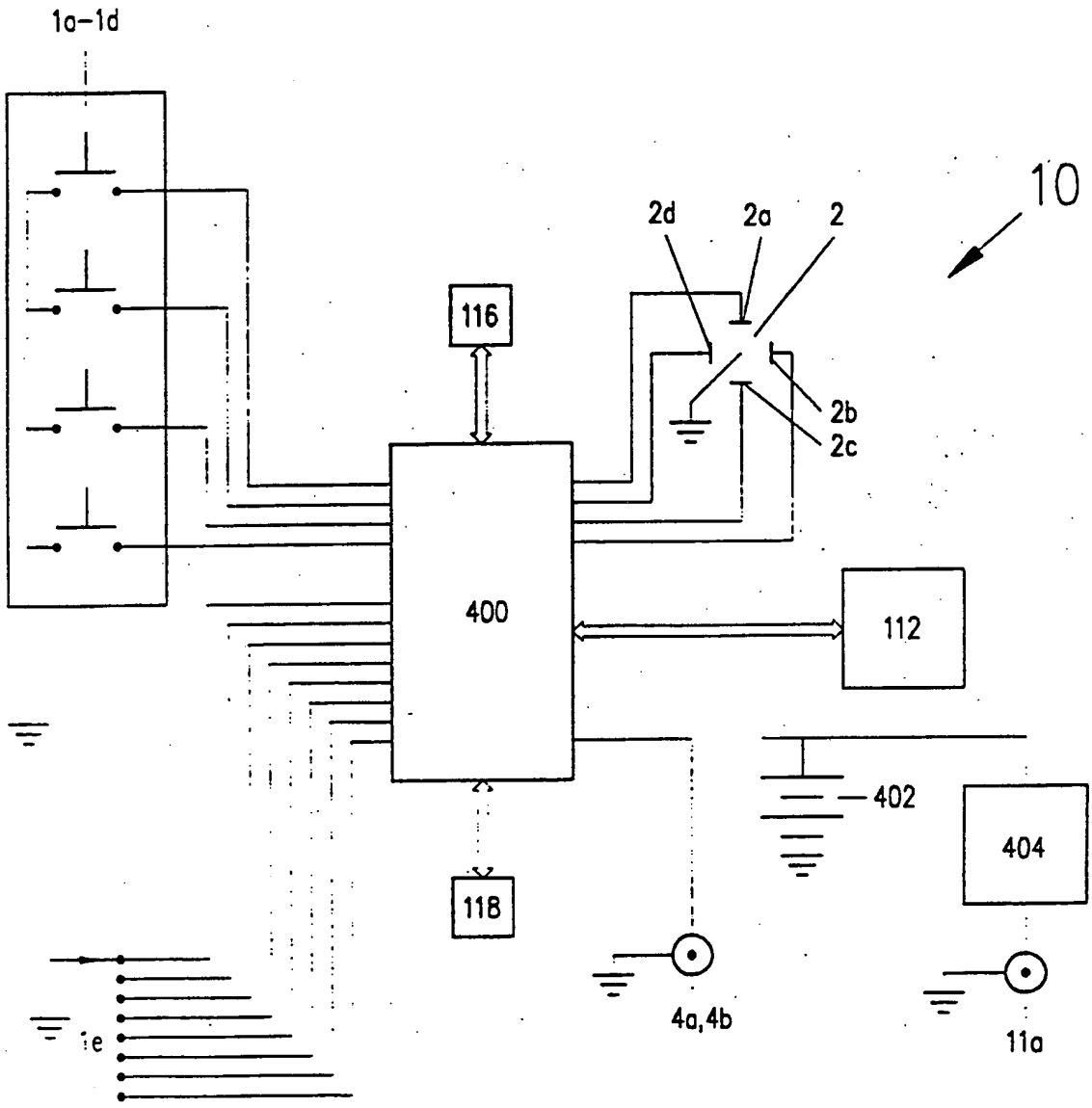


FIGURE 4

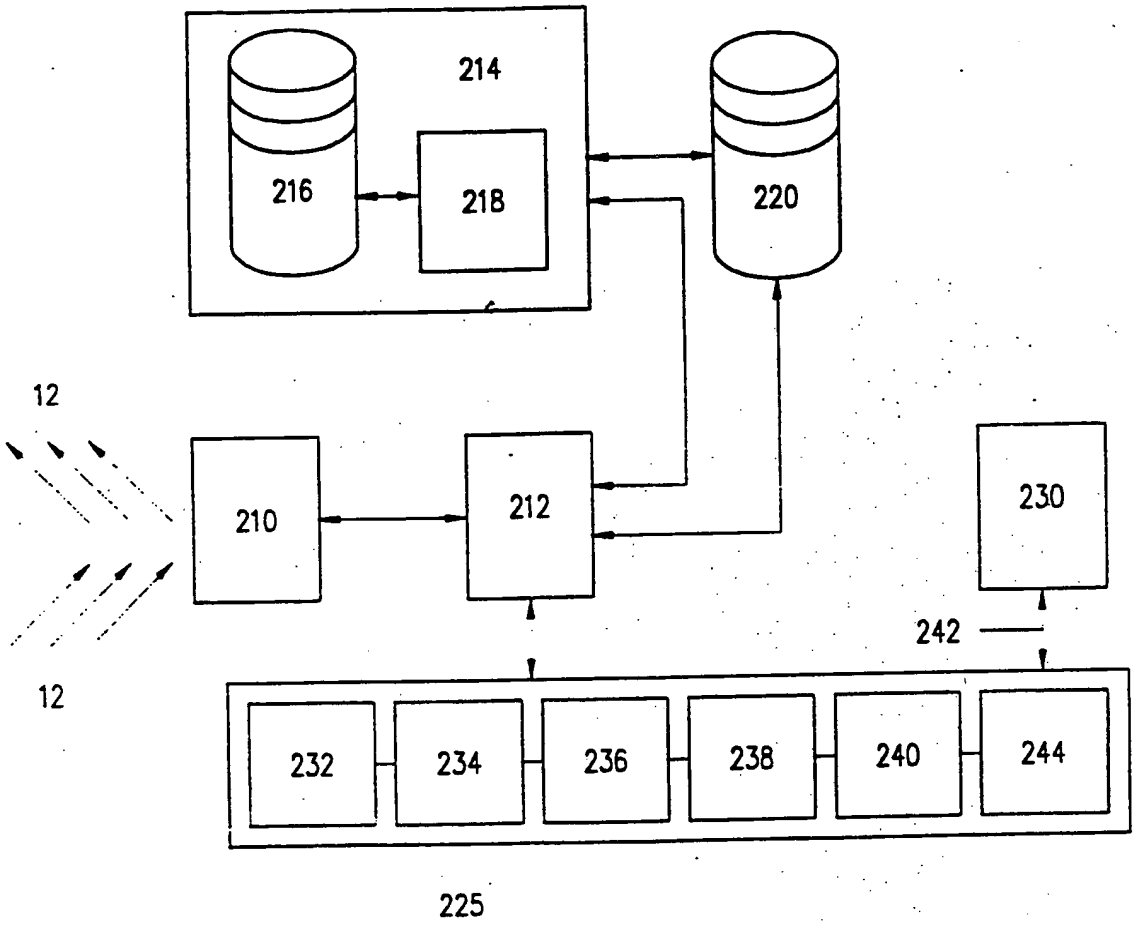


FIGURE 5

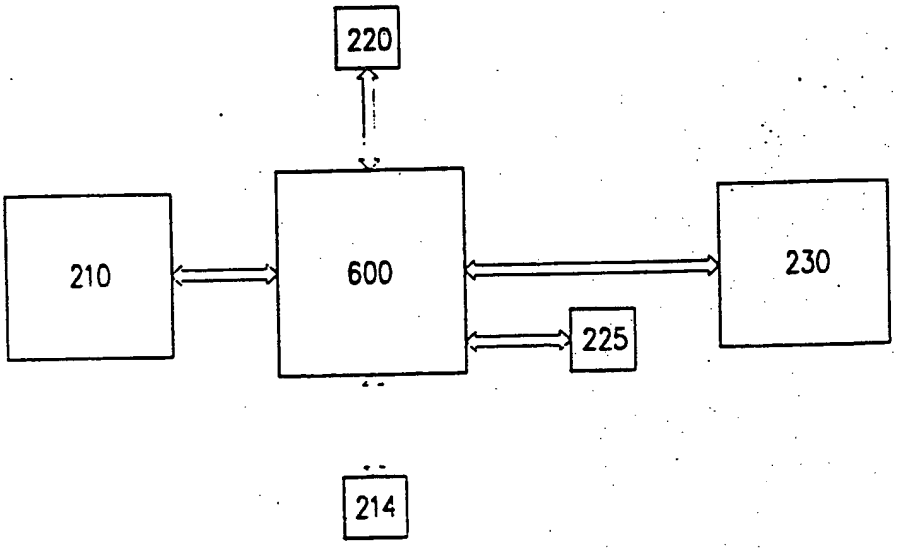


FIGURE 6

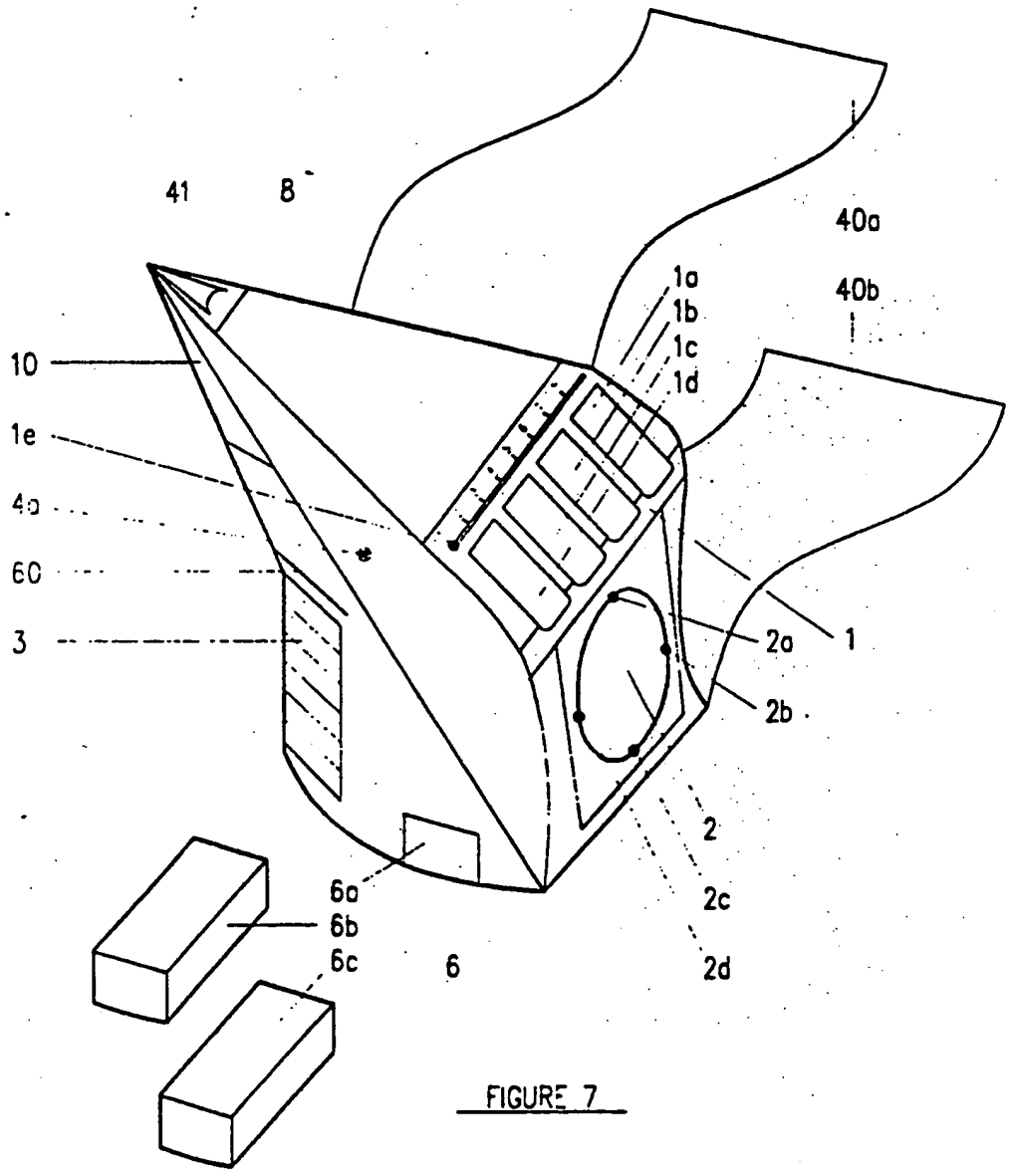


FIGURE 7

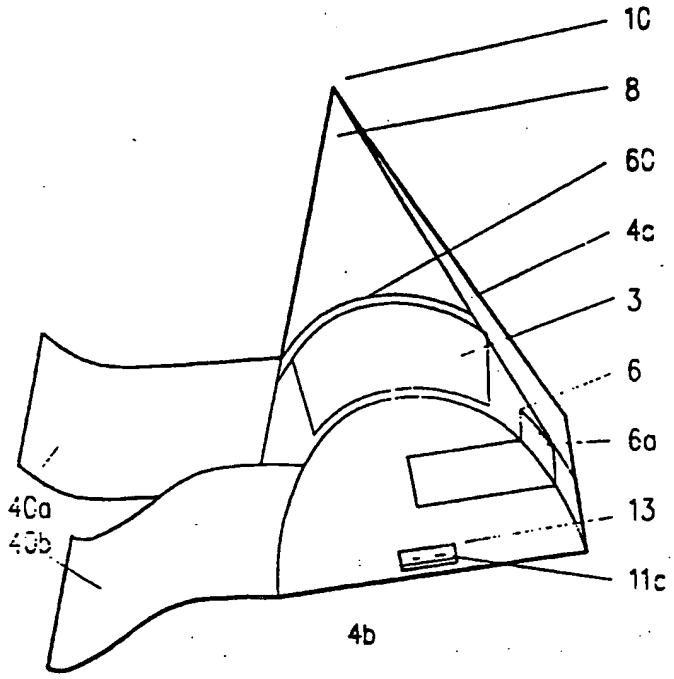


FIGURE 8

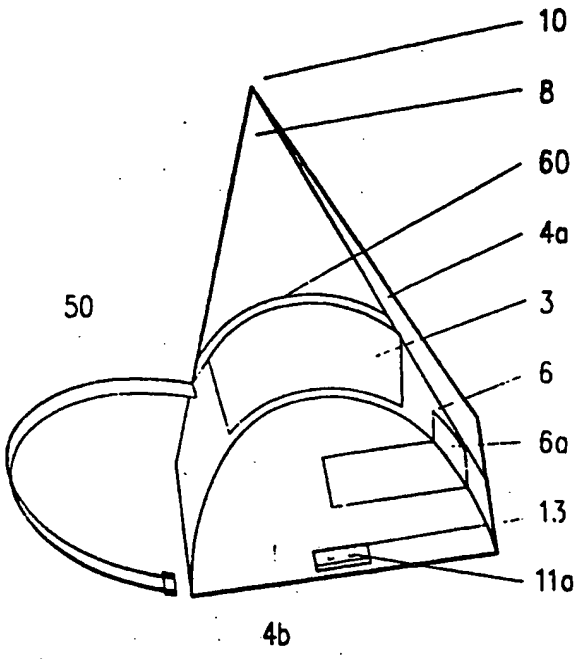


FIGURE 9

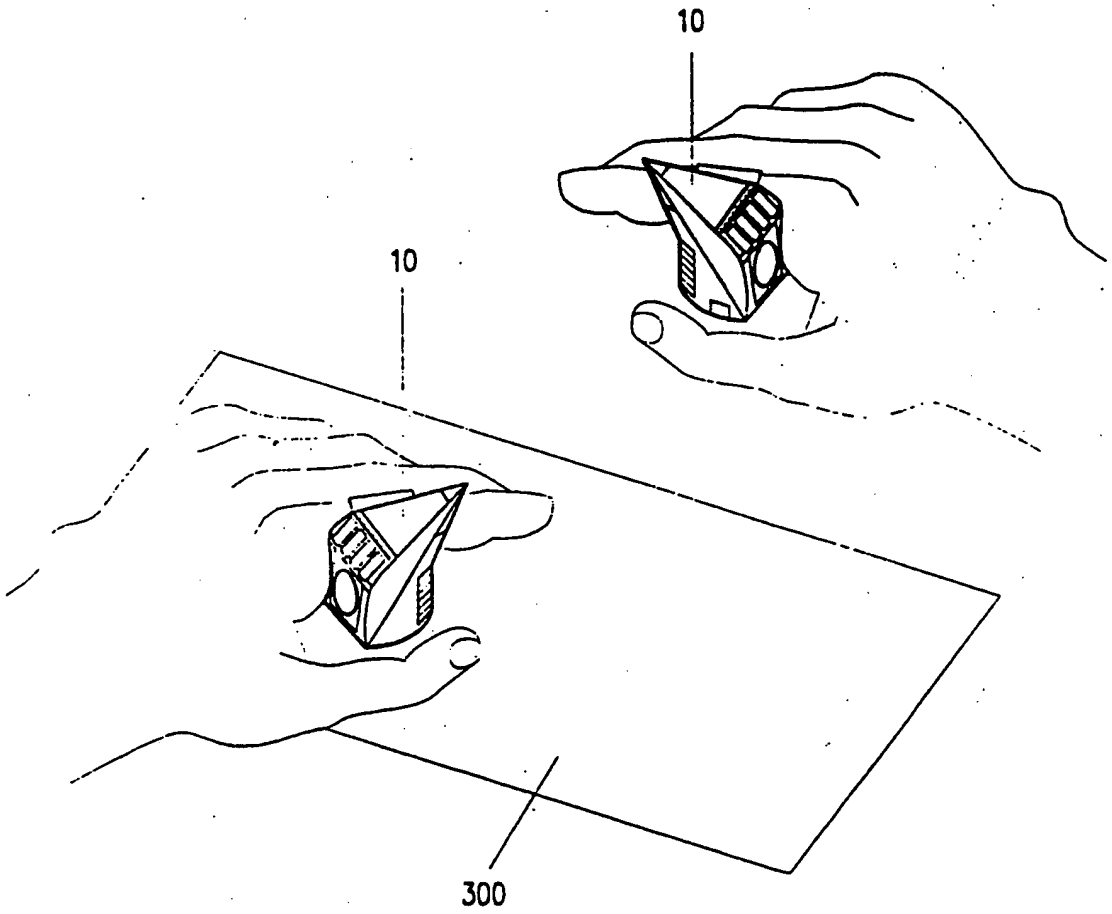


FIGURE 10A

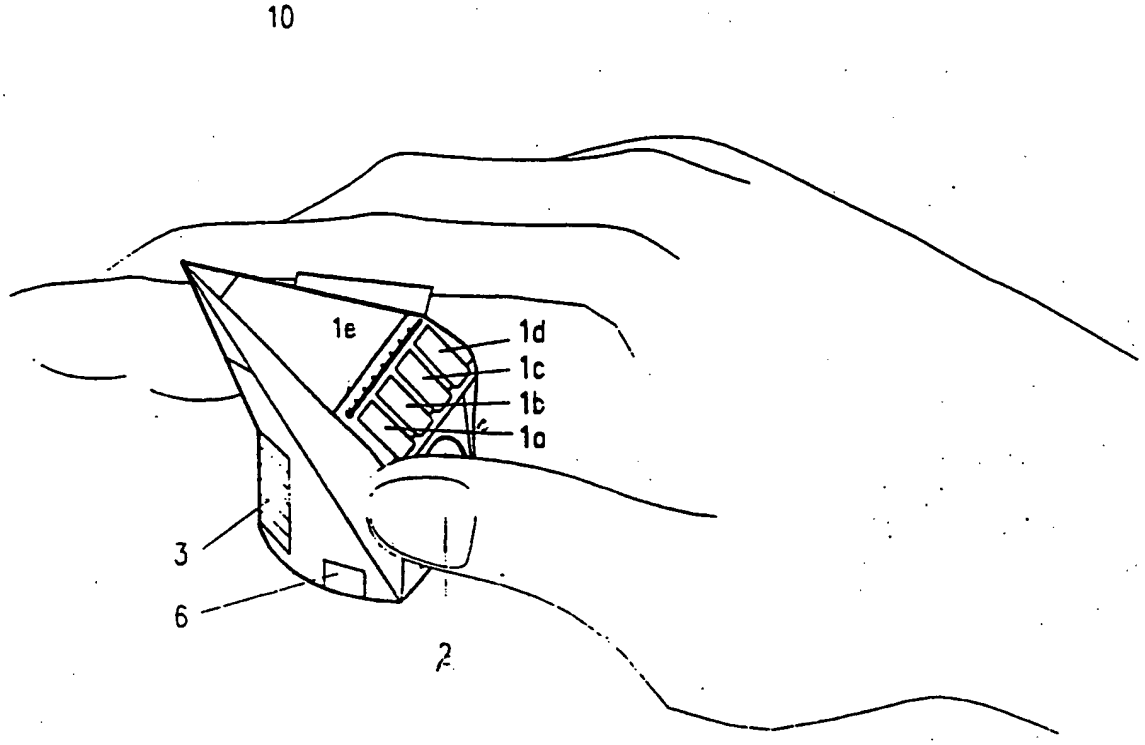


FIGURE 10B

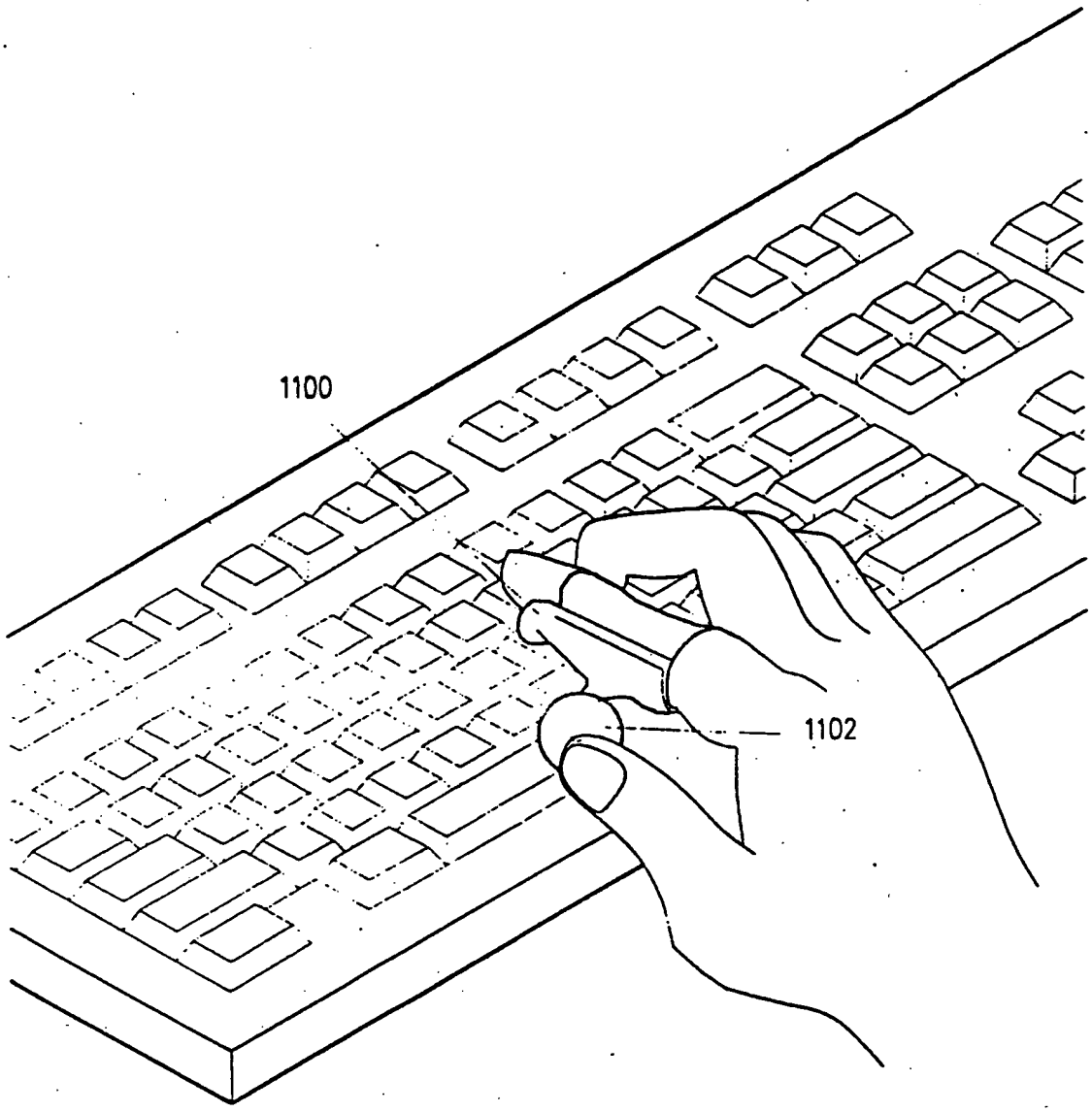


FIGURE 11

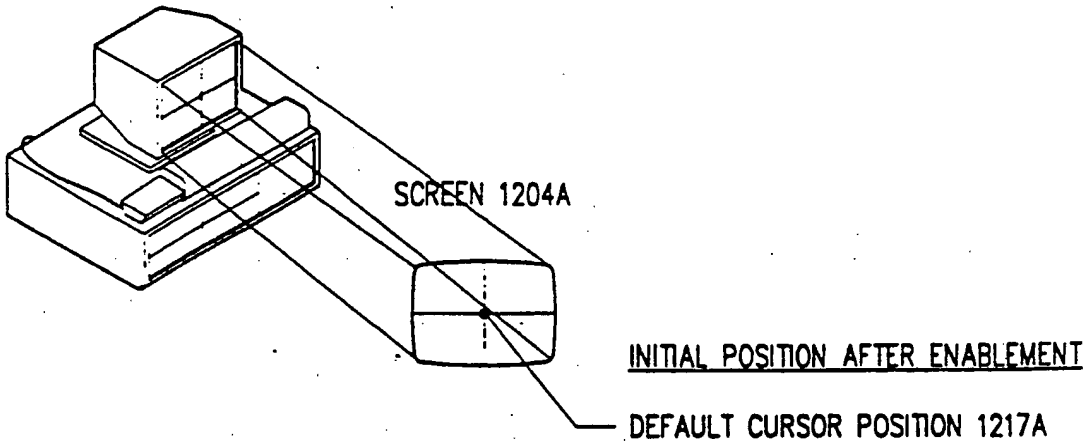
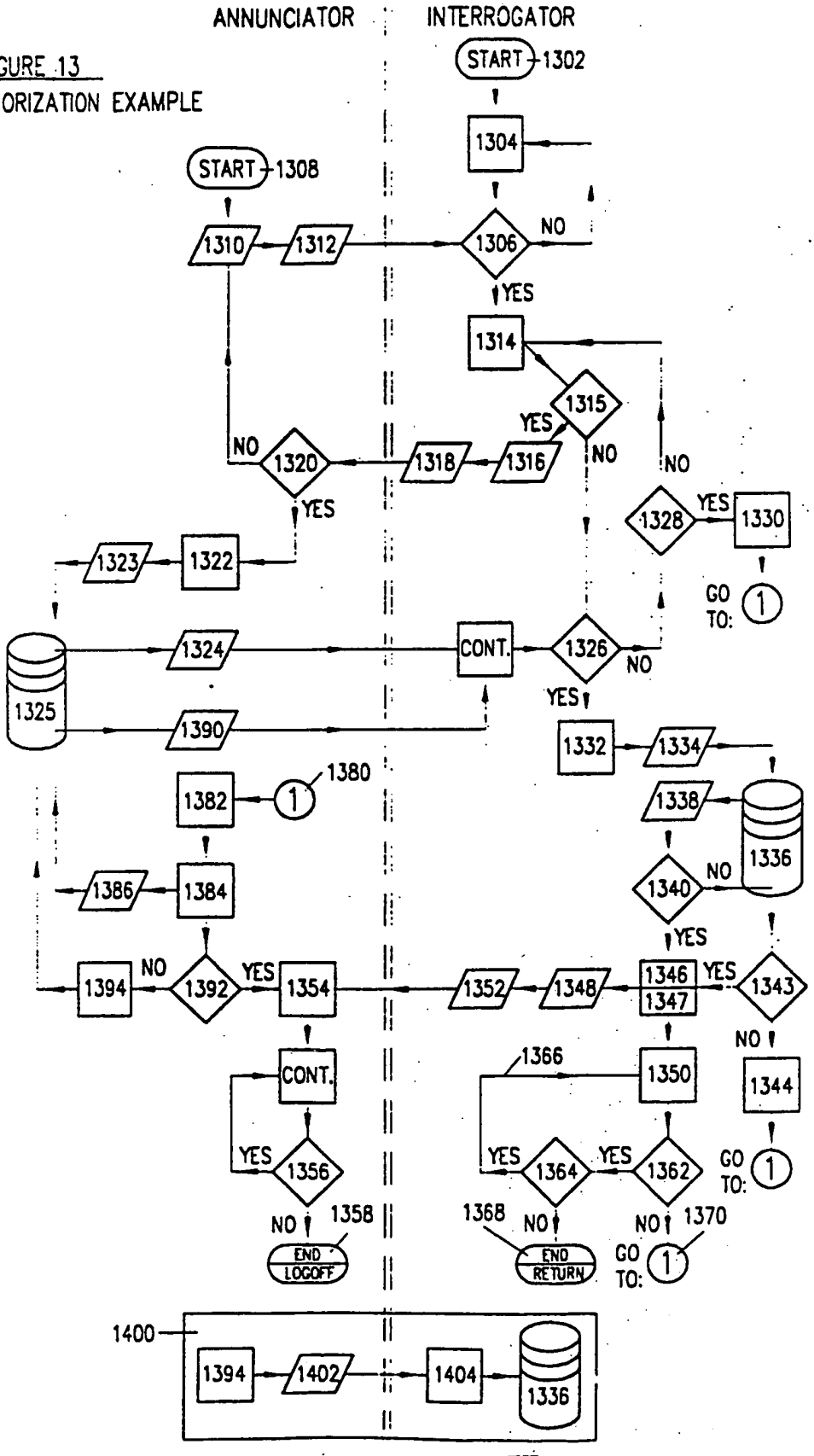
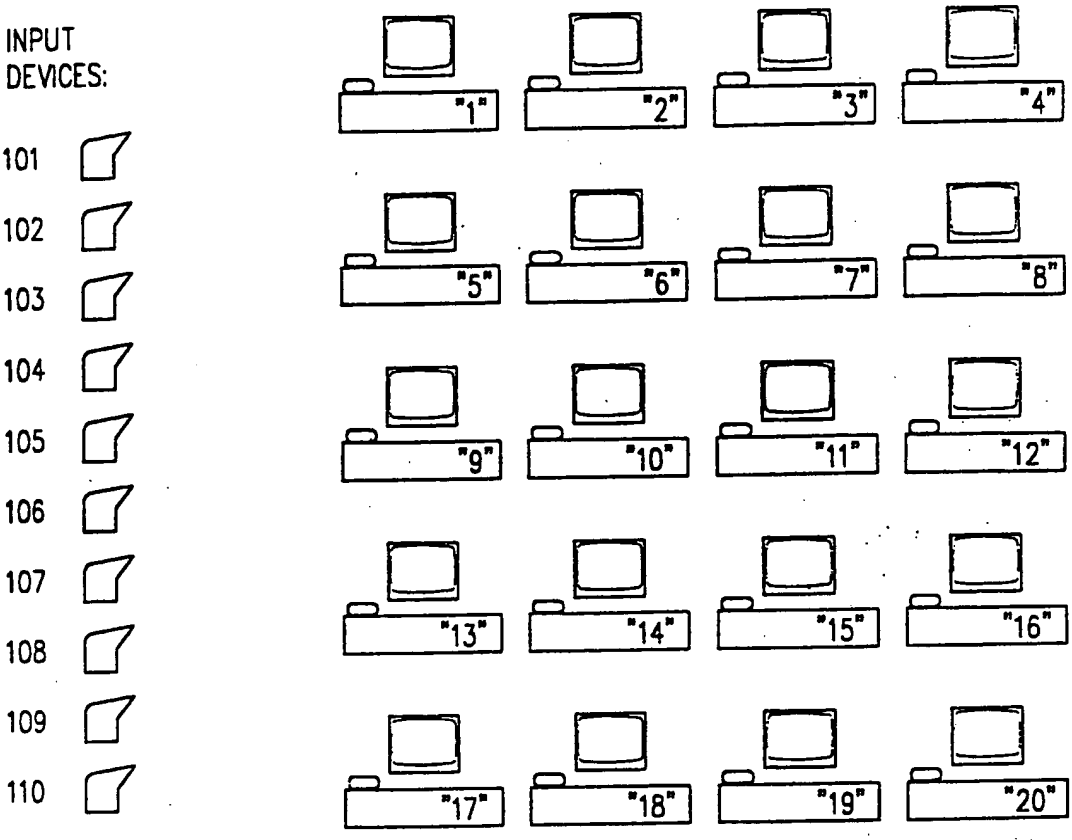

SCREEN 1204A
INITIAL POSITION AFTER ENABLEMENT
DEFAULT CURSOR POSITION 1217A
SCREEN 1204B
CURSOR MOVED TO UPPER RIGHT
NEW CURSOR POSITION 1217B
SCREEN 1204C
CURSOR MOVED TO UPPER LEFT
NEW CURSOR POSITION 1217C
SCREEN 1204D
CURSOR MOVED TO LOWER RIGHT
NEW CURSOR POSITION 1217D

FIGURE 12

FIGURE 13

INPUT AUTHORIZATION EXAMPLE





CUID#	AUTH. COMPUTER(S)	AUTH. LEVEL(S)	USER NAME
101	ALL	ALL (I-V)	SYSTEM ADMIN/GRAND MASTER
102	"2, 3, 4, 5, 6"	I, II	DATA ENTRY
103	"2, 3, 4, 5, 6"	I, II	DATA ENTRY
104	"2, 3, 4, 5, 6"	I, II, III	DATA ENTRY SUPERVISOR
105	"9, 10, 11"	ALL	ENGINEERING
106	"9, 10, 11"	ALL	ENGINEERING
107	"9, 10, 11, 12, 13"	ALL	ENGINEERING SUPERVISOR
108	ALL	I, II	DATA COMMUNICATIONS
109	"13, 14, 15, 16"	I, II, III	PERSONNEL
110	"17, 18, 19, 20"	I, II, III	ADMINISTRATION

FIGURE 14

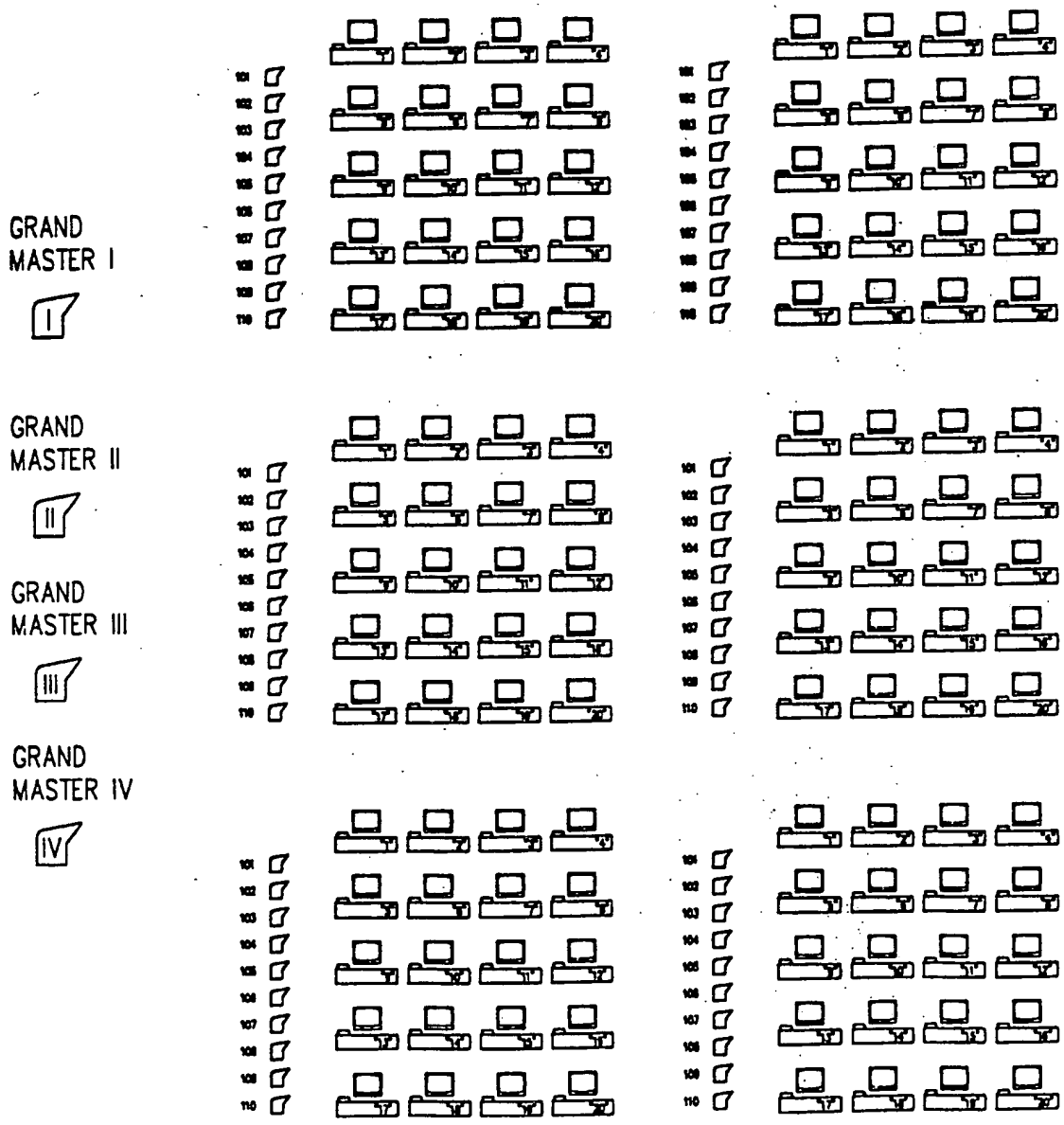
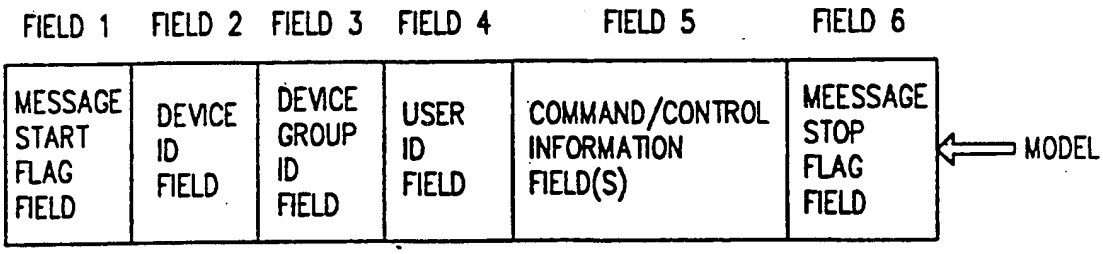

GRAND MASTER I
I
GRAND MASTER II
II
GRAND MASTER III
III
GRAND MASTER IV
IV

FIGURE 15

HIGH-LEVEL SECURITY PERSONALITY



FIELD:

1 WAKE-UP DETECTION CIRCUITRY / MESSAGE FOLLOWS /

2 UNIQUE DEVICE ID & TIME-STAMP & PRIVILEGES

3 UNIQUE DEVICE GROUP ID & TIME-STAMP & PRIVILEGES

4 UNIQUE USER ID & TIME-STAMP & PRIVILEGES

5 USER COMMAND/CONTROL SIGNAL

2D.1 CONTROL/SIGNAL MESSAGE PACKETS { 2D 1.01, 1.02, ⋮

FIGURE 16A

HIGH LEVEL CAX PERSONALITY

MODEL ⇒	FIELD 1 MESSAGE START FLAG FIELD	FIELD 2 USER ID FIELD	FIELD 3 DESIGN MODE ENVIRONMENT FIELD	FIELD 4 DESIGN BASIC ACTIVITY FIELD	FIELD 5 BASIC ACTIVITY LAST STATE FIELD	FIELD 6 BASIC ACTIVITY CURRENT STATE ("DELTA") FIELD	FIELD 7 OTHER RELEVANT INFO

FIELD:

1 WAKE-UP DETECTION CIRCUITRY / MESSAGE FOLLOWS /

2 USER'S UNIQUE ID

3 DESIGN MODE

MANUFACTURING DESIGN
ELECTRICAL ENGINEERING DESIGN
ARCHITECTURAL DESIGN
MUSICAL NOTATION
ETC.

4 BASIC ACTIVITY

INSERT
DELETE

FIGURE 16B

INTERNATIONAL SEARCH REPORT

International Application No PCT/US90/06823

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5) : H03M 11/00; H04B 10/00
U.S. CL : 341/20,22; 340/825.72,706

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	341/20,22,176; 340/825.69,825.69825.72,706,709,711; 455/603,617,608

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X Y	US,A 4,812,842 (BAYERLEIN ET AL) 14 March 1989 See the entire document.	1-12,17,18,19 13-16,20-23
A	US,A 4,897,821 (THIERRY ET AL) 30 January 1990 See Column 2, Lines 41-65; Column 3, Line 53; Column 4, Line 55.	1-13,17-22
A	US,A 4,641,374 (OYAMA) 03 February 1987 See the entire document.	1-13,17-22
A	US,A 4,682,159 (DAVISON) 21 July 1987 See Column 2, Lines 46-61.	1-7,17-19

(con't)

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [5]	Date of Mailing of this International Search Report [6]
05 FEBRUARY 1991	22 FEB 1991
International Searching Authority [7]	**Signature of Authorized Officer [20]**
ISA/US	YUK H. LAU

Form PCT/ISA/210 (second sheet) (May 1986)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	US,A	4,754,268 (MORI) 28 June 1988 See Column 1, Line 43; Column 2, Line 49.	1-7,17-19
A	US,A	4,924,216 (LEUNG) 08 May 1990 See Column 1, Line 25; Column 2, Line 10.	1-7,17-19
A	US,A	4,628,541 (BEAVERS) 09 December 1986 See the entire document.	1-7,17-19

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers . because they relate to subject matter [1] not required to be searched by this Authority, namely:

NONE

2. ☐ Claim numbers . . . . . , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [1], specifically:

NONE

3. ☐ Claim numbers_____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.